

Memorandum

To: File

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From: Chris Garrett, SWCA

Date: August 29, 2013

Re: Review of Available Depth of Flow Information on Cienega Creek and Empire Gulch

Public comments were received on the Preliminary Administrative FEIS that was distributed to the cooperating agencies on July 1, 2013, concerning the analysis of impacts to riparian areas and streamflow in Cienega Creek and Empire Gulch. In particular, USEPA suggested that a "risk assessment" approach be used to address riparian impacts, assessing the range of drawdown that could occur and the impacts that could result under each drawdown scenario.

One key aspect of assessing impacts to streamflow is to identify typical depth of flow that occurs in the channel. The purpose of this memo is to provide a review of available water depth information on Cienega Creek and Empire Gulch, describe the selection of a generalized cross section against which typical drawdown impacts would be applied, and identify what impacts would result for various levels of drawdown.

Three sources of data were identified to review:

- Stage and flow measurements on the USGS Gage on Cienega Creek near Sonoita (gage no. 09484550). The period of record for this gage is from October 1, 2007 through present (August 28, 2013), and approximately 205,300 individual stage measurements are available for review.
- Depth and flow measurements collected as part of water quality sampling on Cienega Creek (data obtained from ADEQ). Four locations in particular were selected: Cienega Creek below Pump Canyon, Cienega Creek below Sandford

Cienega Creek at Stevenson Canyon, and Cienega Creek below Stevenson Canyon. Together, these sampling locations range from 16.2 to 18.2 miles above the confluence of Davidson Canyon, and represent the region of Upper Cienega Creek that is of the most concern from groundwater drawdown.

The period of record for these measurements is from December 1991 through April 2006. These data consist of spot measurements only; between the four locations a total of 21 spot measurements are available.

- Very little information is available for Empire Gulch, but one report was reviewed with some pertinent information (Bodner and Simms 2008). In particular, Figure 26 contains data from two spot measurements on Empire Gulch.

Review of USGS Gage Data

The stage data on USGS gage no. 09484550 represent the most complete and continuous source of information concerning depth of flow on Cienega Creek. During the period of record, flow ranged from 0 cubic feet per second (cfs) to 2,060 cfs. At zero flow, the stage measurement ranges from 0.43 to 0.7 feet; for the purposes of this analysis, a stage measurement of 0.43 feet can be assumed to be equivalent to a stream depth of 0 feet.

Over the period of record, approximately 90% of the time the calculated depth of the stream falls between 0.48 and 0.8 feet, with a median and average of 0.66 feet.

Review of Point Measurements

The 21 point measurements for depth associated with water quality sampling range from 0.18 feet to 1.25 feet. Over the period of record, approximately 90% of the time the measured depth to water falls between 0.23 and 1.12 feet, with a median of 0.46 feet and an average of 0.51 feet.

Review of Empire Gulch Measurements

These measurements are of limited use, since they only describe two snapshots in time (1993 and 2006). In 1993, the total wetted depth of the channel cross-section appears to be about 0.2 feet. In 2006, the total wetted depth of the channel cross-section appears to be about 1.5 feet.

Selection of Typical Flow Regime

The purpose of this review is to select a reasonable generalized flow depth from which to base impact assessments for Cienega Creek and Empire Gulch. The actual impact would vary greatly depending on many factors. Actual impacts to streamflow would depend on the specific channel geometry, hydraulic connection with the regional aquifer, and riparian vegetation characteristics at a specific location. Channel geometry and flow characteristics are highly variable, even within short distances. This is evident from the high longitudinal variability exhibited during annual stream presence/absence monitoring conducted downstream within the Pima County Cienega Creek Natural Preserve. In addition, even at any given location channel geometry is constantly shifting over time in response to sediment loads and changes in flow. This analysis is not intended to capture these nuances. The purpose of this analysis is to generalize potential impacts that would occur along a long stretch of channel, recognizing that localized impacts can be greater or less, just as impacts during drought cycles can be greater and impacts during wet climatic cycles can be less.

Based on the available data, a reasonable typical depth of flow in these stream reaches is assumed to be 0.6 feet, with a typical range between 0.2 and 1.2 feet. The typical depth of flow of 0.6 feet will be used to assess possible impacts to streamflow due to drawdown. The range of depths (0.2 to 1.2 feet) will be used to extrapolate the possibility of losing flow at locations along the entire reach.

Impact Conclusions

The following summarizes how ranges of drawdown will be characterized in the FEIS:

Range of Drawdown (feet)	Assumed Average Depth of Flow (feet)	Assumed Range of Depth of Flow along Reach (feet)	Conclusion for Streamflow
≤0.1	0.6	0.2 to 1.2	Unlikely to result in any noticeable loss of flow
>0.1 and <0.4	0.6	0.2 to 1.2	Noticeably reduce streamflow but not result in widespread absence of flow
≥ 0.4 and <0.6	0.6	0.2 to 1.2	Noticeably reduce streamflow and could result in widespread absence of flow
≥ 0.6			Likely cause widespread absence of surface flow for a large portion of the year

REFERENCES

- Bodner, G. and Simms, K. 2008. State of the Las Cienegas National Conservation Area. Part 3. Condition and Trend of Riparian Target Species, Vegetation and Channel Geomorphology. January.